

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

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7/4

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43bis.1)

Date of mailing

(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION

See paragraph 2 below

International application No.
PCT/US2004/031828

International filing date (day/month/year)
27.09.2004

Priority date (day/month/year)
25.09.2003

International Patent Classification (IPC) or both national classification and IPC
H04L1/06, H04L27/34, H04L5/04, H04L1/00

Applicant
QUALCOMM INCORPORATED

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:



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Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
 - ☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
 - ☐ a sequence listing
 - ☐ table(s) related to the sequence listing
 - b. format of material:
 - ☐ in written format
 - ☐ in computer readable form
 - c. time of filing/furnishing:
 - ☐ contained in the international application as filed.
 - ☐ filed together with the international application in computer readable form.
 - ☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

Box No. II Priority

1. ☒ The following document has not been furnished:

☒ copy of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(a)).

☐ translation of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(b)).

Consequently it has not been possible to consider the validity of the priority claim. This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

2. ☐ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43*bis*.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.

3. ☐ It has not been possible to consider the validity of the priority claim because a copy of the priority document was not available to the ISA at the time that the search was conducted (Rule 17.1). This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.

4. Additional observations, if necessary:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-42
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-42
Industrial applicability (IA)	Yes: Claims	1-42
	No: Claims	

2. Citations and explanations

see separate sheet

Re. item V

Reference is made to the following documents:

- D1: KANNAN RAMCHANDRAN: "MULTIRESOLUTION BROADCAST FOR DIGITAL HDTV USING JOINT SOURCE/ CHANNEL CODING" IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, IEEE INC. NEW YORK, US, vol. 11, no. 1, January 1993 (1993-01), pages 6-22, XP000377993 ISSN: 0733-8716
- D2: E. G. LARSSON, P. STOICA: "Space-Time Block Coding for Wireless Communications pp. 1-4, 5, 6, 8, 9, 87, 88, 97-100" May 2003 (2003-05), CAMBRIDGE UNIVERSITY PRESS, CAMBRIDGE, UK, XP002316665 ISBN: 0 521 82456 7
- D3: COVER T M: "BROADCAST CHANNELS" IEEE TRANSACTIONS ON INFORMATION THEORY, IEEE INC. NEW YORK, US, vol. IT-18, no. 1, January 1972 (1972-01), pages 2-14, XP000939271 ISSN: 0018-9448
- D4: HEATH R W ET AL INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS: "Multiuser diversity for MIMO wireless systems with linear receivers" CONFERENCE RECORD OF THE 35TH. ASILOMAR CONFERENCE ON SIGNALS, SYSTEMS, & COMPUTERS. PACIFIC GROOVE, CA, NOV. 4 - 7, 2001, ASILOMAR CONFERENCE ON SIGNALS, SYSTEMS AND COMPUTERS, NEW YORK, NY : IEEE, US, vol. VOL. 1 OF 2. CONF. 35, 4 November 2001 (2001-11-04), pages 1194-1199, XP010582229 ISBN: 0-7803-7147-X
- D5: AMRAOUI A ET AL: "Coding for the mimo broadcast channel" ISIT 2003, 29 June 2003 (2003-06-29), pages 296-296, XP010657324
- D6: TEN BRINK S ET AL: "Detection thresholds of iterative MIMO processing" PROCEEDINGS 2002 IEEE INTERNATIONAL SYMPOSIUM ON INFORMATION THEORY. ISIT 02. LAUSANNE, SWITZERLAND, JUNE 30 - JULY 5, 2002, IEEE INTERNATIONAL SYMPOSIUM ON INFORMATION THEORY, NEW YORK, NY : IEEE, US, 30 June 2002 (2002-06-30), pages 22-22, XP010601734 ISBN: 0-7803-7501-7
- D7: WITZKE M ET AL INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS: "Iterative detection of MIMO signals with linear detectors"

CONFERENCE RECORD OF THE 36TH. ASILOMAR CONFERENCE ON SIGNALS, SYSTEMS, & COMPUTERS. PACIFIC GROOVE, CA, NOV. 3 - 6, 2002, ASILOMAR CONFERENCE ON SIGNALS, SYSTEMS AND COMPUTERS, NEW YORK, NY : IEEE, US, vol. VOL. 1 OF 2. CONF. 36, 3 November 2002 (2002-11-03), pages 289-293, XP010638218 ISBN: 0-7803-7576-9

D8: WO 02/089371 A (HUGHES ELECTRONICS CORPORATION) 7 November 2002 (2002-11-07)

D9: WO 01/39456 A (THOMSON LICENSING S.A; SETTLE, TIMOTHY, FORREST; KRAUSS, THOMAS, PETER) 31 May 2001 (2001-05-31)

OBJECTIONS WITH RESPECT TO ARTICLE 6 PCT

1. The application does not meet the requirements of Article 6 PCT, since the claims are not concise and fail to define the essential features of the invention.
 - a. The claims are not concise. There are 6 independent claims in the category of apparatus, i.e. claims 17, 18, 35, 37, 41, 42, and 6 independent method claims, i.e. claims 1, 14, 22, 23, 31, 38. The various definitions of the invention given in these independent claims are such that the claims as a whole are not concise, contrary to Article 6 PCT, in particular since the subject matter represented in the different claims overlaps to such an extent that they could have easily been formulated as a two independent claims in each category (ie. one for the transmission and one for the receiving side) and dependent claims as appropriate.
 - b. Due to the multiple independent claims in each category the set of claims as a whole further lacks clarity due to the complete lack of consistency between the independent claims in defining the essential features of the invention.
2. The independent apparatus claims 17, 18, 35, 37, 41, 42 do not meet the requirements of Article 6 PCT since their subject-matter is not clear for the following reason:

These claims define "An apparatus in a wireless system". It is not clear from the wording whether protection is sought for the apparatus on its own or only when implemented into a wireless system.

ANALYSIS WITH RESPECT TO ARTICLE 33 PCT

3. The subject-matter of independent method claim 17 does not involve an inventive step over the disclosure of document D1.

Document D1 is directed to the transmission of base and enhancement information [page 6, right-hand column, 2nd paragraph].

According to the essential features of present claim 17, document D1 which is considered to represent the most relevant state of the art, discloses (the corresponding features of D1 are given in brackets):

An apparatus for transmitting a base and an enhancement stream for obtaining a first data and a second data symbol stream [page 6, right-hand column, 2nd paragraph and Fig. 1]

- in which the first and second data symbol stream are combined by superimposing the two symbol streams [page 10, right-hand column, 2nd paragraph: "superimposing the detail information within the coarse information"].

Consequently, the subject-matter of claim 17 differs from the apparatus of D1 in that the signal is transmitted from one antenna, whereas claim 17 defines an apparatus with a plurality of transmit antennas and corresponding spatial processing of the data.

The problem to be solved by the present invention may therefore be regarded as *how to improve the transmission apparatus disclosed in D1?*

Multi-antenna systems with spatial multiplexing are well-known in the art (see eg. D2, section 7.2). It is well-known that these systems provide increased data rate and increased robustness in case of fading channels.

The skilled person, therefore, being aware of the disclosure of D1 would apply common general knowledge of the art (D2 etc.) in order to solve above stated problem. He would provide a transmission apparatus having multiple antennas and in addition to the channel coder shown in D1, Fig. 1 provide a spatial multiplexing device. He thus arrives at a apparatus according to claim 17 without involving an inventive step.

As a consequence, claim 17 does not meet the requirements of Article 33(3) PCT for lack of inventive step of its subject-matter.

4. Regarding independent claims 1, 14, 18, 22, 23, which are directed to the transmission side, the following is remarked:
- i. For the broadcast channel, two fundamental transmission schemes are well-known in the art: time sharing and superposition of the signals [D1, section IV-A, D3, page 2, right-hand column and section VII].
 - ii. For multi-antenna systems, two fundamental transmission schemes are well-known in the art: space-time coding (eg. the Alamouti scheme) and spatial multiplexing [D2, section 6.3.1, 7.1 and 7.2, see also D4, section 2, 2nd paragraph]

With claims 1, 14, 18, 22, 23 the Applicant seeks protection for all possible combinations of the transmission schemes according to a) and b) for the base and enhancement streams.

However, since a skilled person would, when improving the system of D1, consider all these combinations, which are well-known in the art. As a result, these claims do not meet the requirements of Article 33(3) PCT for lack of inventive step of their subject-matter.

5. Regarding independent claims 31, 35, 37, 38, 41, 42, which are directed to the receiving side, the following is remarked:
- i. Receivers having multiple antennas are also well-known in the art [see D2, Fig. 1.1 and 2.1].
 - ii. Time sharing at the transmission side requires necessarily a demultiplexer at the receiving end.
 - iii. Multistage decoding ("estimating interference due to decoded base stream") has also been disclosed in D1 [page 10, right-hand column, last paragraph] (see also D8, Fig. 4A, 4B or D9, Fig. 1).

As a result, these claims do not meet the requirements of Article 33(3) PCT for lack of inventive step of their subject-matter.

6. The dependent claims do not contain any features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT in respect to inventive step (Article 33(2),(3) PCT), in particular:

- i. Claims 12, 13: multi-carrier and OFDM transmission are well-known in the art.
 - ii. Claims 34, 36: iteration between detection and decoding in MIMO systems is disclosed in D5, D6 and D7.
7. It appears that the whole application does not contain inventive matter based on which a claim, which meets the requirement of Article 33(3) PCT, could be formulated.